

# The Importance of Water Quality for Human Consumption



Forest Brook Middle School  
7525 Tidwell Street  
Houston, Texas, USA 77016

Students:

Kathanette Williams  
Carlos Castaneda  
Jinae Miles  
Dahndre Thomas

Albert Segundo

Jose Garcia  
Keyla Lopez  
Leonardo Anaya  
Alexia Fontenot

Sixth Grade Science Instructor: **Ranjana Robertson**  
Teacher Intern: Janet Reynolds

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# **Abstract**

This is a study conducted by sixth grade students at Forest Brook Middle School in Houston, Texas, (Longitude 95.2622, and Latitude 29.9988). There were four types of water samples taken to determine the pH and temperature of water samples of the bodies of water surrounding the school. Municipal samples were collected by the students. Samples ranged from tap water in their homes to water from the fountain at school. Spring water samples were collected by the teacher at a spring located at a nearby post office. River samples were collected by the teacher at a river near her residence. Brook samples were collected by the students with the help of their teacher, at the brook on the school premises. All samples were tested for pH and temperature.

# Sample Origins

## Sample 1

Location – **City of Houston**

Latitude – 29.9988    Latitude = 29 degrees 59.9 min. North

Longitude – 95.2622    Long = 95 degrees 15.7 min. West

A sample of **municipal** water was brought in by each student that is participating in the GLOBE project. All of the students live within a five mile radius of the school's location on Tidwell Road in Houston TX. The sampling of water ranged from tap water in their home to the drinking fountain at their school.

## Sample 2

Location – **San Jacinto River**

Latitude – 29.9988    Latitude = 29 degrees 59.9 min. North

Longitude – 95.2622    Long = 95 degrees 15.7 min. West

Details – The San Jacinto **River** rises at the San Jacinto dam on the southern rim of Lake Houston in northeastern Harris County, TX (at 29 degree 55' N, 95 degree 08'W) and flows southeast for 28 miles to its mouth on Galveston Bay east of Houston (at 29 degree 41' N, 94degree 59'W)

Nearly level terrain is surfaced by clay and sand that support loblolly pine-sweet gum, loblolly pine-short leaf pine, water oak-elm, pecan-elm, and willow oak-black gumwoods along the river's bank.<sup>1</sup>

Water usually is low and slow.

Low hanging tree branches and brush coupled with low water and a narrow channel can make paddling difficult, but not threatening to boats and boaters.

The San Jacinto River is not a favorite because of its remoteness, low and slow current, narrow channel with overhanging vegetation and lack of good access points, but it is a beautiful and scenic river lined with pine and hardwood forests near the Sam Houston National Forest and the W.G. Jones State Forest. There are no commercial liveries on the river.<sup>2</sup>

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<sup>1</sup> The Handbook of Texas Online – San Jacinto River, [www.tshaonline.org](http://www.tshaonline.org)

<sup>2</sup> Southwest Paddlers – San Jacinto River, [southwestpaddler.com](http://southwestpaddler.com)

# Sample Origins

## Sample 3

Location – **Humble, Texas**

Latitude – 29.9988    Latitude = 29 degrees 59.9 min. North

Longitude – 95.2622    Long = 95 degrees 15.7 min. West

A **natural spring** oozes out water continuously at an intersection in front of the Post Office in Humble, 77338. Two years ago Government took care of it by surrounding it with rocks and beautified the area with plants. So, there is no naturally grown vegetation by it.

The Latitude and Longitude is the same as above but Temperature was 70.7 degree Fahrenheit at 12:30 P.M. on March 23, 2010.

## Sample 4

Location – **Houston**

Latitude – 29.850011    Latitude = 29 degrees 59.9 min. North

Longitude – 95.294303    Long = 95 degrees 2915.7 min. West

Details –Forest Brook Middle School, 7525 Tidwell Road, Houston TX 77016

There is a man made **brook** that runs from Sims Bayou located in Northeast Houston. While constructing the school building in 1972, the architects determined that the area was at sea level. In order to prevent flooding, a brook was designed to alleviate water overflow to the school as well as the surrounding community. This sampling was done near the end of the brook and upstream near an area of heavy foliage.

## Hypothesis

One measure of the quality of water can be related to the balance of acids and bases in the water, or the sample pH.

# Municipal Water

## Research Questions

What affects the quality of water in residential homes?

What is the source of residential water for Houston?

What affects the pH level of residential water?

*Water quality within the United States is highly regulated, involving strict guidelines and water quality testing. As a result, drinking water in the United State is among the safest to drink in the world. Although water quality in the United States is high, there are still some underlying problems. Therefore, both local and federal governments work constantly to ensure everyone in the community has safe drinking water. Water for human consumption is considered drinking water.*

*Drinking water comes from two major sources.*

*Surface water such as lakes, rivers and reservoirs provide much of the water used as drinking water. Groundwater, which is pumped out from wells, is also a source of drinking water commonly used in rural areas. Surface water typically requires both filtration and disinfection in order to reach drinking water quality standards.*

*Groundwater is considered to be the purest source of water, because it is naturally filtered when it passes through the layers of rock and sediment in an aquifer.*

*Today, the Environmental Protection Agency (EPA) and water quality standards ensure groundwater undergoes technological treatment as well. Most water systems add chlorine or other disinfectants to purify the water within the water distribution system to ensure the highest quality.<sup>3</sup>*

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<sup>3</sup> [www.wisegeek.com](http://www.wisegeek.com)

# River Water

## Research Questions

What affects the water supply of a river?

How are rivers formed?

Can water from a river be used for human consumption?

*San Jacinto River Authority (SJRA)*

*As one of 10 major river authorities in Texas, our mission is to develop, conserve, and protect the water resources of San Jacinto River watershed.*

*Lake Conroe- situated seven miles west of the City of Conroe at the Lake Conroe Dam. Exclusively operated by the SJRA, the City of Houston owns two-thirds interest in the lake; SJRA owns one-third.*

*Highlands, located in East Harris County where the SJRA owns Lake Houston. Raw water from the lake is diverted*



*into an extensive 1400-acre reservoir for delivery to customers such as Exxon-Mobil Company, and other pursuant to long-term water contracts.<sup>4</sup>*

*Rivers are generally formed by the melting of snow in regions close to the poles in both southern and northern hemisphere. This river is used to supply water for human consumption after it has been filtered, treated and tested. During a drought season, residential water is restricted. For example, landscape water may be limited to specific times during the day. This is because the level of the river has dropped due to lack of rain which supplies the river with its water.*

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<sup>4</sup> [www.sjra.net](http://www.sjra.net)

# Spring Water

## Research Questions

What affects the water supply of spring water?

How are springs formed?

Can the water flowing in the spring be used for human consumption?

*Most of the water that emerges at springs is meteoric in nature: that is, it originally fell as rain or snow on the surface of the Earth. At hot springs near active volcanoes, some of the water may have originated from magma, molten rock that also contains dissolved substances such as water. As magma cools and crystallizes in the Earth's crust, it releases much of this water. Spring water also can be ancient sea water, although it usually is diluted with meteoric water.*

*A spring can be formed where groundwater naturally emerges from the Earth's subsurface in a defined flow and in an amount large enough to form a pool or stream-like flow. Springs can either discharge fresh water onto the ground surface, directly into the rivers or streams, or directly into the ocean above sea level. Springs form the headwaters of some streams.*

*Conceptually, the groundwater system associated with spring is simple. It consists of:*

- *A recharge area where water enters the subsurface*
- *An aquifer or set of aquifer through which the water flows*
- *A discharge point where water emerges as a spring*

*The existence of a spring requires that below the surface, the infiltrating water encounters a low permeability zone and is unable to continue to move downward as fast as it*

*is supplied at the surface; as a result, the water spreads laterally until it intersects the land surface where erosion has lowered the topography to the water's level.<sup>5</sup>*

*Most spring water is usable for human consumption; however it is best to have water tested for contaminants before consuming.*

***The pH of a solution** is a measure of the molar concentration of hydrogen ions in the solution and as such is a measure of the acidity or alkalinity of the solution. The letters pH stand for "power of hydrogen" and the numerical value is defined as the negative base 10 logarithm of the molar concentration of hydrogen ions.<sup>6</sup> The pH and the temperature of all samples were measured by the students. The pH scale measure how acidic or alkaline a substance is. The pH scale ranges from 0 to 14, acidic to alkaline, with a pH of 7 being neutral. A pH less than 7 is acidic. A pH greater than 7 is alkaline. Temperature was measured in Farenheight and converted to Celsius.*

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<sup>5</sup> [www.waterencyclopedia.com](http://www.waterencyclopedia.com)

<sup>6</sup> <http://hyperphysics.phy-astr.gsu.edu/HBASE/Chemical/ph.html>

# Brook Water

## Research Questions

Why are brooks made?

Can the water flowing in the brook be reused?

What affects the ph level of a brook?

Is brook water safe for human consumption?

***A brook is** a small water stream. A brook usually contains water from heavy rains and is used to hold water for the reason of possible floods.*

*A brook's **water can be reused**. It depends on how the water is going to be used and the quality of the water. If the water resource from where the brook water comes from has*

*too many acids or bases then the water cannot be reused.*

*You may be able to reuse the water if it is neutral.<sup>7</sup>*

*Brooks and canals are made for many reasons. One of the reasons is to prevent floods. Another reason is to drain water from other resources or to move water from one place to another.<sup>8</sup>*

*Brook water is not usually used for human consumption.*

*Heavy rains will affect the amount of water found in a brook.*

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<sup>7</sup> Google.com

<sup>8</sup> Ask.com

# Materials and Methods

- Each student used a mid-stream method, (allow water to run 3 seconds before sampling) for collecting their municipal sample – 1000ml beaker then placed into plastic bottles.
- When collecting the river sample plastic bucket, was used with a dip and catch method.
- When collecting the spring sample 1000ml beaker and capped bottles, were used with a mid-stream method.
- When collecting the brook sample – nylon string, plastic bucket, capped plastic bottles, latex gloves, and safety goggles were used with a drop and draw method.
- All samples were transferred to clean plastic containers to prevent contamination. Safety goggles, pH strips, digital thermometers, Latex gloves were used when testing samples.

# Data

Municipal Water	pH	Degree F	Degree C	Location by zip code
Sample 1a Leonardo	6.0	78.2	25.67	77016
Sample 1b Keyla	5.5	75.9	24.39	77016
Sample 1c Dahandre	5.5	75.5	24.17	77016
Sample 1d Kathanette	6.0	72.6	22.56	77016



# Data

Municipal Water	pH	Degree F	Degree C	Location by zip code
Sample <b>1e</b> Alexia	5.5	76.1	24.50	77016
Sample <b>1f</b> Carlos	6.0	78.0	25.56	77016
Sample <b>1g</b> Alberto	5.0	78.0	25.56	77016
Sample <b>1h</b> Jose	6.0	78.8	26.00	77016
Sample <b>1i</b> Jinae	5.5	77.5	25.28	77016

# Data

Source Water	pH	Degree F	Degree C	Location/ zip code
Sample 2 River	9.5	78.9	26.06	San Jacinto River Texas
Sample 3 Spring	9.0	77.9	25.50	Humble, Texas Spring
Sample 4a Brook	6.0	78.6	25.89	Middle of the Brook Houston, TX
Sample 4b Brook	6.0	78.8	26.00	Front of the Brook Houston, TX

# Data

Source Water	pH	Degree F	Degree C	Location/ zip code
* Municipal	5.7	76.7	24.85	Houston, Texas 77016
River Sample	9.5	78.9	26.06	San Jacinto River Texas 77530
Spring Sample	9.0	77.9	25.50	Humble, Texas 77338 Spring
* Brook Sample	6.0	78.7	25.95	Front of the Brook Houston, TX 77016

\*Average of samples

## Analysis and Results

<b>Municipal</b>	Water samples taken from the <b>neighborhood</b> surrounding the school were neutral. The samples taken from the school were similar. The pH of the samples ranged from 5.0 to 6.0. Temperature ranged from 22.56-26.00 degrees Celsius.
<b>River</b>	The samples were more basic than the <b>spring</b> sample. This may be due to the pollutants present. The pH was 9.5. Temperature was measured at 25.50 degree Celsius.
<b>Spring</b>	The samples were less basic than the <b>river</b> samples. This may indicate fewer pollutants in the spring water than the river sample. The pH was 9.0. Temperature was 26.06 degrees Celsius.
<b>Brook</b>	<b>Brook</b> samples seem to have a consistent pH, regardless of the location where it was taken. This may be due to the ecosystem present in the brook. The brook has a pH of 6.0 which indicates the water to be little acidic. Research is in progress as this water is stagnant water. Temperature was 25.45 degrees Celsius.

# Conclusion

Our data have shown that the pHs of most samples are within the neutral range. There were no extreme acidic or basic conditions found. The importance of the pH is related to the quality of water for human consumption.

The municipal samples varied within the neutral area. The students felt that this variation was due to the composition of the plumbing. In many of the homes in the neighborhood water has been supplied through metal pipes. Some of the newer residential homes and apartments are built with pvc (polyvinylchloride), pipes to supply water.

The pH of the brook was extremely constant at 6.0. Students concluded that the presence of life forms and foliage has maintained the ecosystem. They determined that pH effects are important in water quality.

## Discussion:

When researching pH of water the students discovered many facts about water that they were unaware of. They discovered that pure water is neutral. When chemicals are mixed with water they become either acidic or basic.

Examples of acidic substances are vinegar and lemon juice.

Examples of basic substances are ammonia and milk of magnesia. It was discussed that the water samples taken from the neighborhood surrounding the school, were neutral. Water may have been acidic due the presence of tannic acid produced by the purifying of organic matter, and in places where the pH was 9 and 9.5, which is too basic, indicates the presence of lime stones in the beds of those water bodies.

The samples became more basic the further rural it was taken. In municipal areas you have water treatment

plants that treat the water with chemicals. Rural areas possibly have less treatment providing a more natural ecosystem, since more rural areas are involved with agriculture.

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Mrs. C. Flores – Social Studies Teacher (Photographer)  
Dr. R.L. Ford – Texas Southern University - Chemistry  
Department Interim Chair  
Mrs. E. Dykes - Science Teacher

## References/Bibliography:

Sites: All website listed as footnotes.

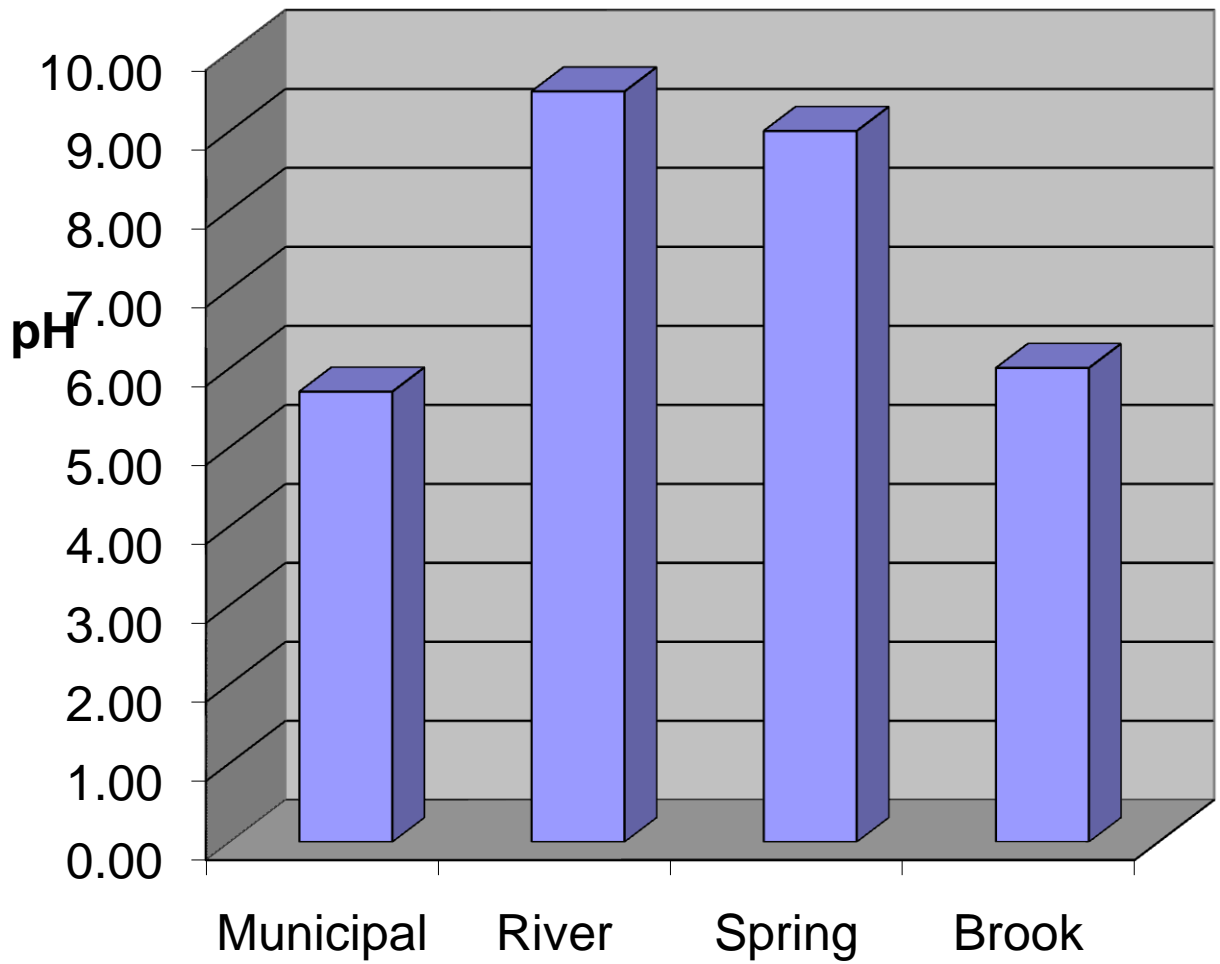
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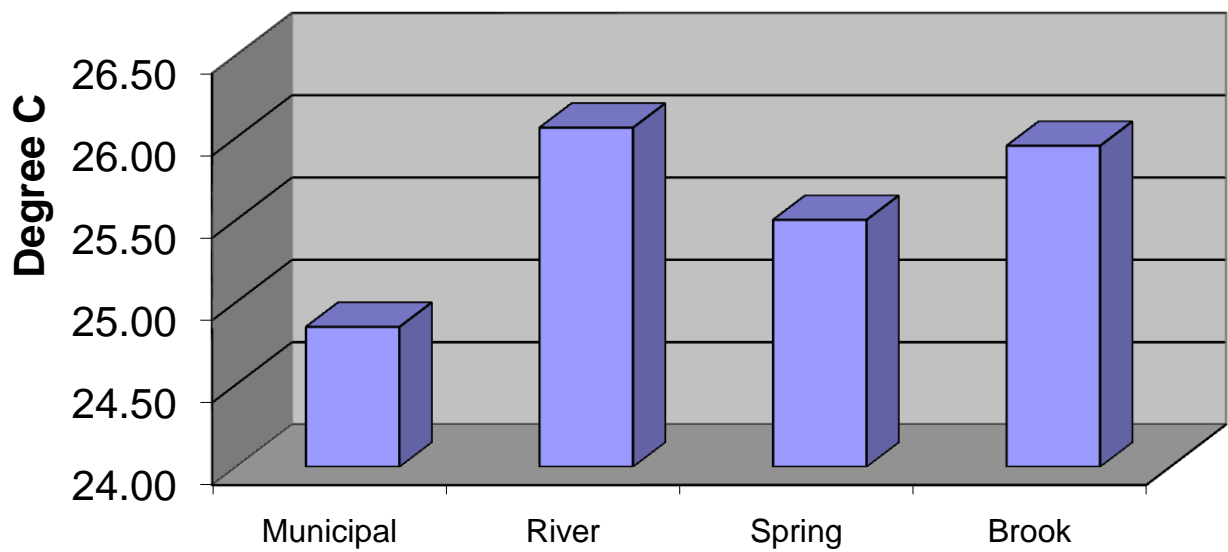




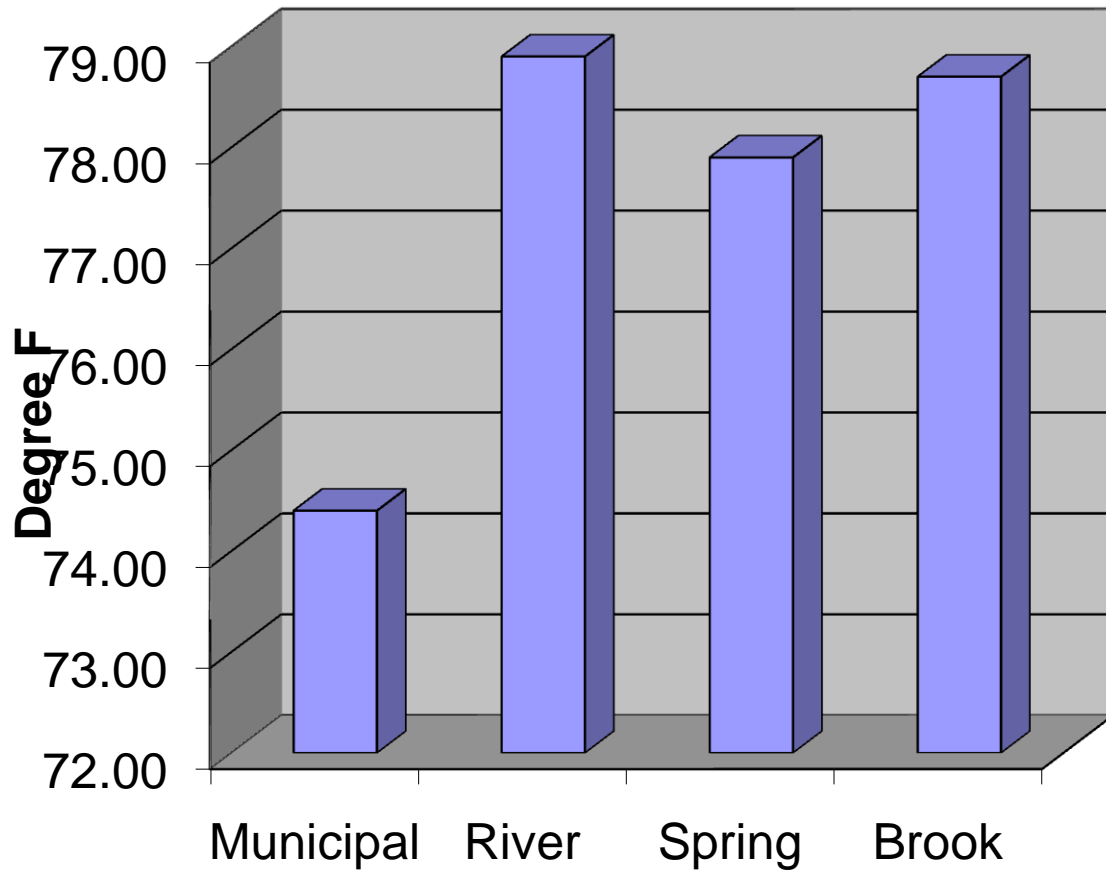
## Globe Water Samples



## Globe Water Samples



## Globe Water Samples



RR/JR